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A Ph.D. Synopsis in the subject of Physics

on

"Studies on Cr and Fe doped ZnO thin films prepared By Chemical Deposition Method"

Submitted to

Swami Ramanand Teerth Marathwada University,

Nanded-431 606

: **Research Scholar:**

Mrs.Pooja Dinkar Wartale

(M.Sc., SET, B.Ed., PET)

Email Id - poojawartale123@gmail.com

Mob. No. 9529411512

Category - Open

: Research Guide:

Dr. K. N. Shivalkar

(M.Sc., Ph.D.)

Associate Professor

Mahatma Gandhi Mahavidyalaya,

Ahmedpur, Dist. Latur.

Email :-knshivalkar@gmail.com

Mob.No. : 8208773793

1.Introduction:

In recent years, thin films have attracted much interest due to various

applications in manufacturing & designing of Semiconductor devices,

Photovoltaic cell, radiation detectors, Laser materials, thermoelectric devices,solar energy convertors.

Zinc oxide possess many interesting properties such as wide band gap. High excitonic binding energy. Piezo-electric polarization. The morphological optical and electrical studies will be undertaken for analysing their compositional structural and transport properties by using X-Raybdiffractometer [XRD] Scanning electron microscopy [SEM] Energy Dispersive Analysis by X-Rays measurement [EDAX] UV-Visible spectrometer of experimental thin flims.

The study will be reported for different doping elements Ike Cr.Fe.It is also

planned to study the electrical resistivity of the prepared thin flims.

Many technique have been used to deposition ZnO films on different substrate these includes filtered vaccum arc.sol-gel process,spary pyrolysis technique [SPT].In SPT there is easy control of roughless leading to light scattering which is useful tool in solar cell and easy of film properties for desired application by changing deposition and post deposition condition.

Resistivity of sparyed doped ZnO has arrived at a stage of favourable comparision with those from other well established deposition techniques such as sputtering

2.Literature Review

M. Ginting: The effect of doping conc.of fe and Cr on ZnO powder wasStudied by using X-Ray diffraction (XRD).The ZnO was doped using solid state reaction method with High speedshaker Mill (HSM) and continued with Sintering at 900 C for 4 Hours. Samples doped with Fe and Cr have poly crystalline Hexagonal Wurtzite structure.

Ababay ketema Worku:

The BET Surface area measurementshows 176.25 m^2 / g for undoped ZnO and 287.17 m^2 /g for 0.1 M Cr- dopingZnO nanoparticles. Thus the addition of chromium in ZnO nanoparticles increases the surface area and themal stability.

zalak Joshi:-

The Synthesized high purity Single phasing nanoparticles of Zno.95

Cro.05 O using low cost, low temperature, easy, simple,Vaccum free and environmentally friendly acetate precursor based sol-gel method. Final product pellets of ZnO.95 Cro.05 O materials, was sintered at different temperatures to study the size effects on dielectric, ac conductivity and improtance properties.

T. Srinivasulu: Fe-doped ZnO (ZnO: Fe) thin films were grown on coming 7059 glass Substrate using & chemical spary pyrolysis method. The effect of fe-doping concentration that varied in the range 0-6 at % on the physical properties of ZnO thin Films was investigated. The paramagnetic nature of and was started to alter into ferromagnetic nature on increasing the Fe-doping concentration.

O Muktaridha: Each Stabilizer generated a smaller ZnO Crystallite size as compared to the control sample. Fe-ZnO crystallite size prepared using chitosan, citric acid and urea as the stabilizer was 14.75, 28.29 and 22.51 nm resp. The crystalline size of Fe-ZnO that was prepared without Stabilizer (control) was 32.89 nm.

B.P. kafle: The small beak widths indicates a good grain size and the fe2+ ions had systematically Substituted Zn^{2+} ions in the samples without significantly changing its crystal structure.

Selma M.H. Al-Jawad:

Zno:Fe thin films were prepared through simple and low cast spin-coating Sol-gel method. The deposited film was 300nm thick, and XRD studies of as deposited samples show polycrystalline structure with hexagonal wurtzite structure of Zno and Fe:zno thin films.

3.Abstract of proposed work plan/problem:

In this Present Research work simple chemical Spray Pyrolysis method is used for deposition of nano-crystaline Praseodymium chalcogenide based thin films. Thin films produced are characterized by using different characterlization SEM. EDAX. XRD. UV. IR. technique suchPhotoeletrochemical characterization technique, etc.

It is also planed to study the applications of Praseodymium thin film to society (Solar cell preparation and super capacitor designing, sensors etc.)

4.Objective of Research:

It is planed to doped ZnO with transition elements Cr and Fe by simple chemical deposition Method.

To analyse the different characterizations such as electrical resistivity, TEP,SEM, TEM, EPAX, SRD, RR, PEC, etc. studied for prepared thin film.

5.Methodology to be adopted:

The optical, physical and electrical properties of Zinc Oxide deposited

The chemical spray pyrolysis will be used to deposit metal oxide thin films. The work will be carried out in the following manner

a) Spray deposited Thin Films.

Here we use spray pyrolysis technique to deposit uniform thickness thin film of metal oxide on conducting and non-conducting substrate like glass at different concentration and temperature.

b) Structural Studies: (XRD)

X-Ray diffraction (XRD) technique gives idea about crystal structure, interplanar spacing, lattice planes, lattice parameters ,micro strain, dislocation density. Number of crystallitesper unitarea and crystallite size will be obtained and correlated with the film properties.

c) Morphological: (EDAX)

The morphological study of metal oxide thin films will be studied by using Scanning Electron Microscopy (SEM) or Atomic Force Microscopy (AFM). The grain size, surface roughness, and porosity will be studied using SEM or AFM techniques.

d) Compositional Studies:

The compositional analysis of as deposited metal oxide thin films will be studied by using Energy Dispersive Analysis by X-Rays (EDAX) technique. The correlation between as taken composition and film composition will be obtained.

e) Optical Studies:

The optical absorption spectra of Metal oxide thin films will be obtained by using a UV-Vis-NIR (Ultraviolet-Visible-Near Infrared) spectrophotometer. The coefficient of absorption, band gap energy (Eg), nature of transition, power factor will be determined from optical absorption spectra.

6.Importance of Study/Society Application:

-The work is planned only by considering its attempt not done at international level.

-It is applicative in optical coatings and light emitting materials.

-The outcomes of the study will be for welfare of society at national and international levels.

7.CHAPTER SCHEME

Chapter 1: Introduction.

Chapter 2: Experimental and characterization methods

Chapter 3: Synthesis, Properties of Cr-doped ZnO thin films

Chapter 4: Synthesis properties of fe-doped ZnO thin films

Chapter 5: Result and analysis by using XRD, UV,IR etc

Chapter 6 : Summary and Conclusion

8.YEAR WISE PLAN OF WORK:

It is proposed to synthesis of ZnO thin flims doped with elements like Chromium(Cr), Iron(Fe) using the simple chemical deposition technique. We planned to characterize synthesized thin films morphologically, optically, and electrically.

Sr No	Academic Year	Year Wise Plan
1	2023-2024	Coursework Data collection. Study of related literature. Submitting FIRST six-monthly Report First phase of practical work Submitting SECOND six-monthly
2	2024-2025	Second Phase of Practical work. Submitting Third Six-monthly report. Statistical analysis of data Publication of papers in Physics Journals. Submitting FOURTH Six-monthly report. Attending Conference on related work.
3	2025-2026	Submitting FIFTH six-monthly report. Attending Conferences on related work. Submission synopsis to SRTMU, Nanded. Submission of thesis.

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Research Scholar

Wartale pooja dinkar

[M.Sc .,SET,BEd.,PET]

Email ID: poojawartale123@gmail.com

Mob. No.:9529411512

Research Guide

Dr. K. N. Shivalkar

[M.Sc. , P.hD]

Assistant Professor

Mahatma Gandhi Mahavidyal,

Ahemdpur ,Dist:Latur.

Email ID:knshivalkar@gmai.co

Mob. No. 8208773793